

CLAIMS

1. A semiconductor device (200) including a semiconductor region having a pn junction (101) and a field shaping region (201) located adjacent the pn junction (101) to increase the reverse breakdown voltage of the device, wherein the field shaping region (201) is insulating material and is coupled to first and second capacitive voltage coupling regions (204,205) provided to apply, in use, substantially the same voltages as are applied to the pn junction, the material and capacitive coupling of the field shaping region (201) being such that, when a reverse voltage is applied across the pn junction (101) and the device is non-conducting, a capacitive electric field is present in a part of the field shaping region which extends beyond a limit (108,109) of the pn junction depletion region which would exist in the absence of the field shaping region, the electric field in the field shaping region inducing a stretched electric field limited to a correspondingly stretched pn junction depletion region (208,209) in the semiconductor region.
2. A device as claimed in claim 1, wherein the field shaping region insulating material has a dielectric constant greater than that of silicon dioxide.
3. A device as claimed in claim 2, wherein the field shaping region insulating material has a dielectric constant greater than that of silicon nitride.
4. A device as claimed in claim 3, wherein the field shaping insulating material is tantalum oxide Ta_2O_5 .
5. A device as claimed in any one of claims 1 to 4, wherein the insulating field shaping region (61) is adjacent only one of the p side (32) and the n side (11) of the pn junction (34).
6. A device as claimed in any one of claims 1 to 4, wherein the insulating field shaping region (71) is adjacent and bridges both the p side (32) and the n

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side (11) of the pn junction (34).

7. A device as claimed in claim 5 or claim 6, wherein there is a said insulating field shaping region (61,71) adjacent only one side of the lateral
5 extent of the pn junction (34).

8. A device as claimed in claim 5 or claim 6, wherein there is a said insulating field shaping region (201) adjacent both sides of the lateral extent of
10 the pn junction (101).

9. A device as claimed in any one of claims 1 to 4, wherein at least one of the first and second capacitive voltage coupling regions comprises one of the p (112,123) and n (113,124) semiconductor regions which form the pn junction
15 (111,122).

10. A device as claimed in any one of claims 1 to 4, wherein at least one of the first and second capacitive voltage coupling regions (62,72) comprises a more highly doped semiconductor region (14) of the same conductivity type and adjacent one of the p and n semiconductor regions (11) which form the pn
20 junction (34).

11. A device as claimed in any one of claims 1 to 4, wherein at least one of the first and second capacitive voltage coupling regions comprises a conductive material region (204,205).
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12. A device as claimed in claim 11, wherein the conductive material region (204,205) is integral with a main electrode (104,105) of the device.

13. A device as claimed in any one of claims 1 to 12, wherein the
30 capacitively coupled insulating field shaping region (81) is separated by an insulating region (82) from the semiconductor region having the pn junction.

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14. A device as claimed in any one of claims 1 to 13, wherein the device is a diode device (200) and pn junction (101) is the rectifying junction of the diode device.

5 15. A device as claimed in any one of claims 1 to 13, wherein the device is a bipolar transistor (90) and the pn junction is the junction between the base region (92) and a collector drift region (93) of the device.

10 16. A device as claimed in any one of claims 1 to 13, wherein the device is a field effect transistor (60,70) and the pn junction (34) is the junction between the channel accommodating body region (32) and a drain drift region (11) of the device.

15 17. A device as claimed in claim 15 or claim 16, wherein the drift region is non-uniformly doped.

18. A device as claimed in any one of claims 15 to 17, wherein the stretched pn junction depletion region (68,78) extends only partly through said drift region (11).

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